Predicting wine quality based on physicochemical attributes

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Introduction

Quality assessment is an essential step in the wine making process as it helps ensure consistency and consumer satisfaction. The quality of wine has historically been evaluated by wine makers and sommeliers, who leverage their training and expertise to determine if a product meets acceptable standards Langstaff (2010). While there have been advancements in the detection of the physicochemical properties of wine and how they relate to flavour Polášková, Herszage, and Ebeler (2008), quality assessment remains a subjective metric.

Here we ask if wine quality can be predicted using machine learning. Our focus is to create an interpretable linear regression model trained on physicochemical wine data to perform this task. The utility of such a model is two-fold as it can be used as a tool to help less experienced wine makers and sommeliers get a sense of the quality of a given wine. Furthermore, the model would help to provide a more objective framework for wine assessment through interpretation of its coefficients. To achieve this, we will train our model on data related to vinho verde white wines from the Minho region of Portugal which contains the physicochemical and sensory data of 4898 wines Cortez et al. (2009).

Methods

Data

The data was obtained from the UC Irvine Machine Learning Repository Dua and Graff (2017). The dataset contains physicochemical and sensory data related to 4898 white wines Cortez et al. (2009). The physicochemical data include: fixed acidity, volatile acidity, citric acid, residual sugar, chlorides, free sulfur dioxide, total sulfur dioxide, density, pH, alcohol, and sulfates. These physicochemical data are emperically measured and will be used as features for our predictive model. The sensory data contained in the data set refers to the quality of the wine, which was subjectively measured by wine experts and represented as a score out of ten. This will be the target of our predictive model.

The distributions of the features can be seen in Figure 1. By taking a look at the individual distributions of the variables, we can see that the majority of them are approximately normal with some degree of right-skew. This tells us that most of the values tend to cluster around the average, possibly an industry standard, with the more extreme values tending to fall above the average rather than below it. The distributions of residual sugar and alcohol content break this pattern as the residual sugar plot follows a more exponential pattern, and the distribution of alcohol content is still approximately normal but also shows a tendency towards uniformity.

Analysis

Results and Discussion

References

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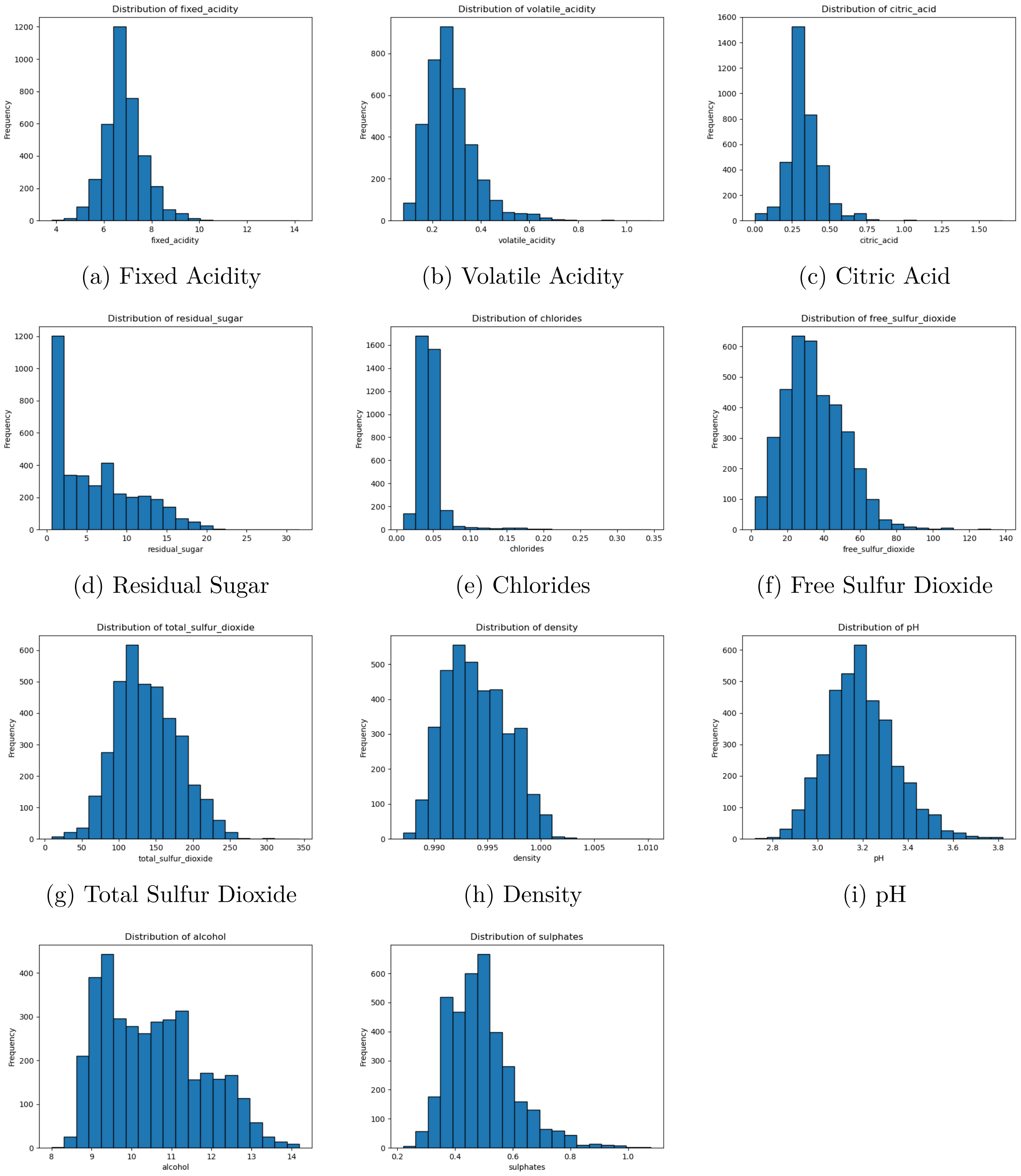

(a) Fixed Acidity

(b) Volatile Acidity

(c) Citric Acid

(d) Residual Sugar

(e) Chlorides

(f) Free Sulfur Dioxide

(g) Total Sulfur Dioxide

(h) Density

(i) pH

(j) Alcohol

(k) Sulphates

Figure 1: Physicochemical Feature Distributions